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London County Council.

THE PORT OF LONDON.

REPORT OF CHIEF ENGINEER.

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With the exception of the works carried out by the Thames Conservancy under the powers obtained in 1905, the engineering questions which now arise are the same as those which were dealt with by me in 1902 after the report of the Royal Commission on the Port of London.

The difficulties under which the Port of London is labouring at the present time are well known and may be summarised under four heads—

1. Insufficient depth of water in the estuary of the Thames and in the river to allow large ships to safely reach the docks at all times.
2. Insufficient dock accommodation.
3. Insufficient dock equipment and arrangements for loading and unloading ships and distributing goods, thereby causing ships to remain a long time in dock.
4. Divided authority in the port of London and financial difficulties of some of the authorities.

In addition to the above, the heavy port and dock charges, as compared with other ports were also referred to in the evidence before the Royal Commission, but these probably would not have been considered so severe if they had been accompanied by quick despatch in loading, unloading and coming into dock, and by a satisfactory arrangement for distribution.

It was generally shown by the evidence that improvements in the port of London to keep pace with the increasing size of ships had been on a very small scale, while other ports were making all improvements possible to attract trade. The loss of trade in the port of London up to the present time may not be of a very serious nature, but it seemed to be the general opinion of witnesses, that unless immediate steps were taken to improve the port, the falling off in trade would in the near future assume very serious dimensions. The increase during the last few years in the size of ships has been enormous, and, as one of the witnesses remarked, "the economical ship is the large ship, and unless you can provide for the large ship you cannot compete for the carrying trade."

In addition to goods coming to the port for distribution in London, and for distribution from London by rail, very considerable evidence was given with reference to the re-export or foreign transhipment trade, which is a most important and extensive business. As the size of ships increases the amount of transhipment is naturally increased. At one time the transhipment of a very large proportion of goods for foreign countries took place in the port of London, and it was shown that this trade was decreasing, and likely to further decrease. It was, in fact, anticipated by some witnesses that, instead of goods being transhipped in the port of London for foreign countries, a very large proportion of goods for London would probably be transhipped in foreign ports. The Commission took the view that as regards the re-export of foreign and colonial produce the port of London had lost ground relative to other ports in consequence of the improvements in other maritime cities of the United Kingdom and in adjacent countries.

Returning to the heads under which I have summarised the present deficiencies of the port of London, very considerable evidence with reference to the first, from shipowners, pilots, masters, engineers of docks and others, was placed before the Commission to show the time lost and the danger incurred by steamers owing to the small depth of water available at low water between the Nore and the docks. It was pointed out that should a large ship go up on the tide from Gravesend with the object of entering the Albert Dock, and should she fail from any cause, such as fog, to arrive at the dock in time to enter about high water, it was necessary to return and wait for the next tide owing to the small depth of water at low water for a long way below the dock. In fact, if there was any doubt of not being able to enter the dock it was necessary for the ship to return at once. It was also shown that there was insufficient water between Gravesend and the Nore to enable ships to enter or leave at all times. The Leigh Middle Shoals are the chief obstruction to navigation between the Nore and Gravesend, and extend from near Shoeburyness to Canvey Point, a distance of nearly seven miles. Mr. More, the Engineer of the Thames Conservancy, gave some interesting particulars as regards the delay to ships of different draught arriving off Southend at low water. Vessels drawing 25 feet of water can pass without delay at any time of the tide on 197 days of the year, but might be detained up to 2½ hours on the remaining 168 days. Vessels drawing 26 feet can pass without delay at any time on 109 days of the year, but might have to wait for 3¼ hours on the remaining 256 days. Vessels drawing 28 feet can only pass unhindered at all times on 7 days of the year, and on the remaining 358 days the delay might extend to 4½ hours. In all these cases an allowance of 2 feet of water is given under the keel of the vessel. A detention of even a short time, although not important in itself, may be just sufficient to prevent a ship getting into dock, and mean a loss of a tide. The time lost and the danger to ships is considerable. The loss of money involved in the detention of a large ocean liner must be very great.

The Commission made a definite recommendation as regards the work required to give a

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sufficient depth of water from the Nore to the Albert Dock, and has given an intimation of what they think may be possible west of the Albert Dock after full investigation, and surveys have been made.

The length of the river between the Nore and London-bridge is 47½ miles, made up as below—

	Statute miles.	Statute miles.
From the Nore Lightship to the lower end of Leigh Middle Shoals	½	
Lower end of Leigh Middle Shoals to Canvey Point	6½	
Canvey Point to Mucking Light	7	
Mucking Light to Shore Meade Battery	4½	
Shore Meade Battery to Gravesend	3	
From Nore Lightship to Gravesend		21½
Gravesend to Broadness Point	2¾	
Broadness to Greenhithe	1¾	
Greenhithe to Crayfordness	3½	
Crayfordness to the upper end of Erith Reach	3	
Erith Reach to Crossness	2	
Crossness to Margaretness	1¾	
Margaretness to entrance Royal Albert Dock (Galleons) ...	½	
From Gravesend to Royal Albert Dock...		15¼
Albert Dock to Woolwich Dockyard	1½	
Woolwich Dockyard to Blackwall	2½	
Blackwall to new entrance, Surrey Commercial Dock ...	3¼	
Surrey Commercial Dock to Shadwell entrance, London Docks	1½	
Shadwell entrance, London Docks, to Thames Tunnel ...	½	
Thames Tunnel to London-bridge	1½	
Royal Albert Dock to London-bridge		10¾
From Nore Lightship to London-bridge ...		47½

The above are the distances placed before the Commission, and are useful for reference.

The Commission recommended that a channel of not less than 30 feet in depth at low water of spring tides should be made from the Nore to the entrance of the Royal Albert Dock, and that the width to be adopted for this channel should be 1,000 feet as far as Crayfordness, a length of 29½ miles, and 600 feet from Crayfordness to the Royal Albert Dock, a distance of 7¼ miles. Above the Albert Dock the Commission thought that a depth of 30 feet at low water of spring tides might be attained as far as the new entrance to the Surrey Commercial Docks, a distance of 7¼ miles, and that the minimum width should be 300 feet, with a greater width where possible. Above the new entrance to the Surrey Commercial Docks it is recommended that such deepening and improvement of the river as may be found possible should be carried out as far as the old Thames-tunnel, a distance of 2 miles. The Shadwell entrance to the London Docks is within this last distance.

It may be assumed that there is no engineering difficulty in constructing the proposed deep channel from the Nore to the Albert Dock. As regards the length above the Albert Dock, I am unable, after a careful perusal of the evidence given by the engineers and others connected with the docks to see the necessity for carrying the full depth of 30 feet up to the Surrey Commercial Dock, especially if the basins referred to further on are made, and, considering the risk to river banks and properties. I think a great improvement in depth and width ought to be made in this length of the river, but I do not think it is of the same importance as the approach to the Royal Albert Dock. A very careful investigation of the riparian properties would be necessary before any definite conclusion could be come to. The buildings on the river bank above Albert Dock are almost continuous, and in some cases, in all probability, their foundations are not satisfactory. It must be remembered that all the ground on the south side of the river for a long distance inland, and also a considerable area on the north side, is below Thames high-water level, so that great care would require to be taken to prevent any damage to the river banks. There is no doubt, however, that very considerable improvement could be made in this length of river even if the depth of 30 feet, suggested by the Commission, were not attained. It may also be noted that the Blackwall-tunnel, the Greenwich-tunnel and the authorised Rotherhithe-tunnel are situated in this length of the river. With a depth of 30 feet of water at low water of spring tides the river bed would still be 3 feet above the top of the cast-iron lining of the Blackwall and Greenwich tunnels. In the case of the Rotherhithe tunnel, it would be necessary to reduce the proposed depth of channel to about 25 feet to retain 3 feet of cover.

As the dredging of the river to the depths recommended or suggested would be spread over a considerable period of years, the Commission recommend that in the first instance basins should be dredged to a depth of 30 feet below low water of spring tides opposite the entrances to the various docks, and at four points between the Royal Albert Dock and Gravesend. These basins would form part of the complete scheme, and would, therefore, entail very little extra cost. The Commission state that this recommendation is made in view of the risk and inconvenience suffered at present by vessels of large draught from want of some deep places in which to take refuge if delayed in their passage up or down river by fog or other causes. There is no doubt that the construction of such basins will be of very great

convenience, and they can be constructed in a comparatively short time. They will, moreover, be a guide as regards the amount of dredging required in the river above Albert Dock, and may be so successful that it may not be necessary to deal eventually with that portion of the river in such a complete way as suggested by the Commission.

With reference to the dredging below Gravesend, the Commission recommend that the training wall recommended by the Lower Thames Navigation Commission should be begun as soon as possible, and before any dredging is undertaken below the Chapman Light. Information would thus be gained as to whether any, and if so what amount of, dredging would be required below the Lighthouse. In the report of the Lower Thames Navigation Commission above referred to, paragraph 47 reads as follows :— "If the desired depth of 30 feet at low water of spring tides, or something approaching it, is to be maintained permanently and economically through these shoals (Leigh Middle Shoals) the chief work for effecting the purpose should consist of a training bank extending in a suitable direction eastward from Canvey Island in order to direct and control the currents and prevent in the future such divagations of the channels as have occured in the past." On looking at the map, it will be seen that the river rather suddenly widens at the east end of Canvey Island, near the Chapman Light. This widening is, of course, accompanied by a diminution in the velocity of the current and consequent deposit of some material suspended in the water. It is at this point that the Leigh Middle Shoals begin, and the intention of the training wall is to narrow and train the tidal current so that the velocity may be continued over these shoals, with the hope that a certain amount of the shoals may be scoured away, or at least so that if a dredged channel is made through the shoals, it may not get gradually filled up by deposit. I think it may confidently be hoped from experience at other ports that there would be sufficient scour to erode at all events a portion of these shoals, and this would be helped by the dredging all along the river, because as Sir Alexander Binnie stated in his evidence, "the deepening of the river would, by increasing the tidal capacity, tend to improve the scour in the estuary below." I may, however, mention that the Thames Conservancy are hoping to maintain the channel without the training wall.

The question of the cost of the improvement of the river was fully gone into by the Commission, and the estimate given by Mr. More, the engineer of the Thames Conservancy, who is, of course, thoroughly well acquainted with the cost of dredging and other works on the Thames, for that portion of the proposed channel between the Nore and Albert Dock was, including cost of plant, £1,514,838. Of this length Sir Alexander Binnie handed in an estimate for the portion between Gravesend and the Albert Dock, which corroborated Mr. More's estimate. For the training wall Mr. More gave two estimates, the highest of which was £134,394, and he also estimates the cost of new moorings at £44,302. Mr. More gave no estimate for the improvements required above the Albert Dock, but Sir Alexander Binnie gave a rough estimate of the dredging from the Albert Dock, to the new entrance to the Surrey Commercial Dock as £755,209, including cost of plant. If the various estimates are added together we get—

	£
New channel from the Nore to Royal Albert Dock (Mr. More) ...	1,514,838
Training wall at Leigh Middle Shoal (Mr. More)	134,394
New Moorings (Mr. More)	44,302
New Channel from Royal Albert Dock to new entrance to Surrey Commercial Dock (Sir Alexander Binnie)	755,209
Total	£2,448,743

It is to be noted that in the above estimates the bottom width from Gravesend to Grayfordness, a distance of 8 miles, is taken as 600 feet and not 1,000 feet as recommended by the Commission.

The Commission report that they think a sum of 2½ millions may be required for the deepening and widening of the channel from the Thames-tunnel to the Nore as recommended in the report, including the suggested moorings and subsidiary works.

In examining the details of the estimates given by Mr. More and Sir Alexander Binnie, and comparing them as far as possible with actual costs of other works, it appears to me that in all cases prices sufficiently high have been taken, and ample allowances made for any unavoidable increases in quantity and other contingencies. No allowances have been made for any scouring away of the Leigh Middle Shoal by the proposed training wall, it being assumed that all this work is done by dredging. I can therefore say that it ought to be possible to carry out the works recommended by the Royal Commission for the sum of 2½ millions, and I do not think that even in unfavourable conditions this sum would be exceeded unless in the case of some great calamity such as the unexpected failure on account of dredging of any of the river banks, or on account of any costly protective works for the banks in the upper part of the river being necessary. This last is a point on which it is impossible to attempt any estimate on the information at present available. It may be as well to note here, as was mentioned by Mr. More in his evidence, that in the construction of the proposed training banks care would be necessary so as to interfere as little as possible with the access to Leigh and Southend and the sea frontage extending between these places.

With reference to the maintenance of the new deep channels when made, the Commission states "neither Mr. More nor Sir Alexander Binnie have any doubts as to the power of the tidal currents of the Thames being fully equal to keeping open the continuous channel, when formed, without any serious demand for dredging." This is evidently the view the Commission takes on the matter, but it may be as well to note Mr. More's reply to question 5,475—"I think myself from Albert Dock down to Gravesend, at any rate, the river would maintain itself at that depth, because we already have many reaches where we have that depth, and even a greater depth than that. Of course, when you come to a channel like the Leigh Middle, that would be a most expensive thing to keep open. I may say that, going beyond the Albert Dock higher up, it would be a very difficult thing to maintain a 30-foot channel there." Mr. More

has, of course, a unique experience of the Thames, and his opinion on a matter of this kind is very important. The Commission, in referring to the time for completion of the proposed works, say, "the work should and must be done gradually, and may be spread over from 8 to 10 years." This remark does not refer to the proposed basins, which would, of course, be the first work put in hand, and which could be completed probably in two or three years, or even in a less time, if the necessary plant could be acquired quickly.

For the complete scheme from the Nore to the Thames tunnel the total amount of dredging would probably be about 36 million cubic yards, and it must be remembered that it would be carried out very largely in a great depth of water, necessitating the purchase of special plant.

Since the report of the Royal Commission, the Thames Conservancy, as already mentioned, obtained an Act in 1905 to enable them to form a channel, 1,000 feet wide and 30 feet deep at low-water, from the Nore to Gravesend, thus proposing to carry out in part the recommendations of the Royal Commission. The total estimate placed before Parliament for this work was, for plant, £230,500, expenditure for working, £147,180, making a total of £377,680. Of this amount, the Conservancy, according to the latest return, has spent on plant, £133,544 and on works £38,765. It is hoped that the 30-foot channel to Gravesend may be completed by 1912.

In the latest returns issued by the Conservancy it is stated—

> "That the latest surveys which have been made of the river between the Nore and Gravesend shew the present state of the navigation channel to be as follows, the depths given being the soundings at low water of ordinary spring tides :—
>
> "(*a*) From the Nore to Mucking, a distance of 13½ miles, there is a channel of 1,000 feet wide and 26 feet deep, with the exception of a distance of about 800 feet near No. 4 Sea Reach buoy, where the channel is narrowed to 800 feet by a shoal over which there is a depth of 25 feet only."
>
> "(*b*) Between Mucking and Cliffe Creek, a distance of 2½ miles, the general depth is 25 feet, or over, but there are several patches where the depth is 24 feet only."
>
> "(*c*) From Cliffe Creek to Gravesend, a distance of 4 miles, the general depth is 26 feet, except over several patches where the depth is 24 feet only."

The Conservancy are also dredging the shoals in the river above Gravesend.

With reference to the second and third heads under which I have summarised present deficiencies of the port of London, viz., insufficient dock accommodation and insufficient equipment arrangements for loading and unloading ships and distributing goods, very considerable evidence was given as regards each dock, and a good deal of comparative evidence with regard to the arrangements at other ports.

Estimates were given for certain necessary works at the docks by the dock engineers, and the extension of the Albert Dock with new entrance was considered one of the most necessary large new works. This extension with new shed was estimated at £1,350,000 by Mr. H. C. Bagally, late Engineer to the London and India Docks Joint Committee. The Commission had surveys and confidential estimates made for them by Mr. R. C. H. Davison to arrive at an estimate of the total cost, (1) of bringing into a good state of repair the properties belonging to the London and India, Surrey Commercial, and Millwall Dock Companies ; (2) of effecting such improvements as would be requisite in order to bring the existing docks of these companies to a degree of efficiency which would meet the needs of the port, assuming that the river channels were deepened and enlarged as recommended; (3) of making the proposed extension or new dock near the Royal Albert Dock. The Commission's estimate for the above works was £4,500,000, and they consider the works should be carried out within the next few years. As no indication other than that mentioned above was given by the Commission of the character of the works proposed it is impossible to consider in any way the details of this enormous sum. The Commission, however, quotes what Mr. C. J. C. Scott, the Chairman of the London and India Docks Company, says as regards requirements, which Mr. Scott estimated to cost two or three millions. These were, in addition to the extension of the Albert Dock, the construction at some of the existing docks of new quays, new entrances or passages, dredging operations, the erection of new grain silos and accommodation for refrigerated meat, the acquisition of new tugs and generally increased plant.

The amount of £4,500,000 does not include any enlargement of the Tilbury Docks, and Mr. Scott remarked : "To-day we find that Tilbury is practically full, and if the trade of London goes on developing in the coming ten years as it has done in the past I am perfectly certain that it will be necessary to take into consideration an extension of Tilbury Dock as large as that of the Albert Dock which we now contemplate."

It does not appear that any of the improvements suggested by the Commission contemplate any deep-water quays or jetties to enable ships to discharge their cargo without going into dock, and from the evidence placed before the Royal Commission it appeared to be extremely doubtful whether deep-water quays and jetties of this kind would be of any very great value to the Port of London.

It is true that in some of the largest ports in the world the whole of the business of the port is carried on by means of deep-water quays or jetties, and without any docks, and in speaking of docks I mean water basins which are controlled by gates, so that the level of the water is kept constant inside the gates.

In the case of the two ports with which I am personally most familiar where this method of dealing with cargo is adopted, namely, in New York and Marseilles, there are very special conditions which make it suitable. New York has a deep-water approach which is well sheltered. There are two large rivers, one on each side of the city with a range of tide of only about 5 feet, and the current varies from about 1½ to 2½ miles an hour. I believe the yearly value of the trade of the port of New York is about 80 per cent. of that of the port of London. In the case of Marseilles, where the trade is about 60 per cent. of

that of London, there is practically no range of tide and no current, and the deep-water quays are well protected by a breakwater.

At Hamburg there is only a small tidal range, something like 6 feet, and in this case also the business is carried on at deep-water quays and jetties. At Calcutta, where the range of tide is something the same as in London, a considerable amount of the business is done over-side in the stream, although the greater part of the business is, I believe, done in docks.

The Committee is aware that the range of tide in the Thames is about 20 feet. Deep-water quay walls or jetties would therefore have to be 20 feet higher than would be required for quays in docks giving similar accommodation, and, as far as I can see, the cost of such works would be at least as expensive as the construction of docks. One of the principal differences between docks and jetties is the provision of the entrance and gates for the former. If docks are very small, this may be a very large proportion of the total cost of the docks, but if docks are very large the proportion would be very small. There are, of course, other differences such as excavation and water-tightness which make it unsatisfactory to compare the cost of docks and wharves on the river in a general way, but it may be stated that the cost per foot of quays and jetties in the river varies almost directly with the extent of such quays and jetties, while the cost per foot of quays in docks diminishes as the area of the dock increases.

It is quite obvious that it is more satisfactory to discharge in dock than alongside a river quay, as, in the latter case, there is constant shifting of the vessel owing to the range of tide, and the strong current makes it more difficult for craft in attendance on the vessel. There is also a certain amount of risk from passing traffic, and there is not the same amount of shelter as is obtained in docks.

It may be noted that the new scheme for the port of Antwerp, where the range of tide is about 14 feet, consists of an enormous extension of dock area. At this port the greater portion of the traffic has, up to now, been carried on at deep-water quays. It is therefore evident that the Belgian Government has decided that, although the port business at Antwerp has in the past been carried on satisfactorily at quays, it will be better in the future to carry on the greater portion of it in docks. In nearly all other cases where further port accommodation has been necessary, and where there is considerable range of tide, docks have been chosen in preference to deep-water quays. Although expressing preference for docks as regards the Thames, it is also evident that a certain amount of traffic can usefully be carried on at deep-water quays and jetties and even in mid-stream, but I think this would apply specially to traffic where large mixed cargoes are not dealt with. In the case of the largest ships carrying heavy mixed cargoes it appears to me that it will always be necessary for them to go into dock.

The question as regards whether new facilities for loading and unloading ships should be provided near London or some distance down the river seems to me to be one about which there connot be very much doubt. Any new docks constructed below the Victoria and Albert Docks cannot be much nearer to London than Dagenham on the north side of the river, or Crossness on the south side, either of which points is practically beyond ~~carrying~~ distance. When goods are moved from the dock in barges cart towed by tugs, a considerable distance down the river is not of great importance. The Royal Commission recommended a new dock close to the Victoria and Albert Dock, and I believe that land for such a dock is available, but it cannot be expected that the construction of one new dock is going to deal with the growing need of the port, particularly as there has been no new dock constructed since 1900, and, indeed, very little improvement since 1891. No doubt certain classes of goods must continue to be delivered near London, but it appears to me that the dock accommodation for very large steamers with mixed cargoes must be found at a considerable distance down the river.

If deep-water jetties are constructed they must also be a considerable distance down the river. One large scheme of this kind, at a short distance above Gravesend, has been hanging fire for some years, although, I believe, considerable preliminary arrangements had been made at one time.

The question as to whether the Council should agree to find £2,500,000 for the dredging of the river to the depth recommended by the Royal Commission, and whether it should guarantee interest on £4,500,000, seems to me to be one which it is difficult to answer in the affirmative. Since the report of the Commission, the Conservancy has obtained powers to spend nearly £400,000 in carrying out the dredging programme recommended by the Commission as far as the length of the estuary between the Nore and Gravesend is concerned, and the money for this has been found by a doubling of the tonnage dues on ship for a period of three years from the 1st January, 1906, which is estimated to produce £195,000, the balance required being obtained by borrowing. The port does not seem to have suffered by the increased dues on ships, and I do not know any reason against continuing these increased dues until such dredging as may be necessary is completed. The amount, although not sufficient for each year's work, would be an increasing one every year. I think that a great objection to finding money for a definite purpose is that it is, to a great extent, tying to a definite line of action the hands of whatever port authority may be constituted. I consider it of the greatest importance that any new authority should have a free hand.

No doubt the information obtained by the Royal Commission is of the greatest value, but its recommendation concerning the expenditure of £2,500,000 on dredging will probably require revision in view of the actual cost of work already done, the possibility that the training wall at the Leigh Middle Shoal, estimated at about £130,000, may not be required, and after further investigation of the engineering questions which are sure to arise in dredging the upper reaches. Its recommendation of an expenditure of £4,500,000 on docks, dock equipment, etc., is only based on the *confidential* estimates made by one engineer, which are, I believe, absolutely unchecked.

While therefore I am of opinion that the Council might give considerable financial help to a new port authority I do not think any sums should be definitely allocated to certain works until the new authority has made its own investigations.

MAURICE FITZMAURICE,
Chief Engineer.

To the Rivers Committee.

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